Film

Circuit/Mechanical Descriptions **2**
Cassette Sensing 2
Film 2
Automatic Exposure Control 3
Ion Field Selection 3
Optical Density Increment/Decrement 3
X-ray Switch 4
Fault Isolation **5**
Functional Tests **7**
Manual Film Exposure 7
Automatic Exposure Control 7
Ion Chamber Field Test 8
Adjustment **9**
3-Field Preamp PCB (Ion Fields) 9
Left/Right-hand Table Ion Field Configuration Jumper 9
Ion Chamber Fields Preamp Gain Pot Adjustments 10
Miscellaneous **10**

Circuit/Mechanical Descriptions

Cassette Sensing

When a Film Cassette is loaded into the Film Cassette Tray, the cassettes presence and size are detected by push-button micro-switches. The Table Control PCB (Motron CPU PCB) determines the cassette's size based on which micro-switches have been closed.

Film

A Film switch is located on both the X-ray Control Console (XCC) and the Collimator Housing Console. Each Film switch has two sets of contacts.

When a Film switch is pressed, one set of contacts latches the Hardware Security Relay (K3) on the Table/Generator Interface (TGI) PCB. The hardware security signal from the XCC's Film switch is XCC_SCRTY. The hardware security signal from the Collimator Housing Console Film switch is COLL_SCRTY. When the relay latches TABLE_V- is grounded and the X-ray Arm Assembly Motor is energized through TAST_V-, the K3 relay, and TABLE_V- signal to ground. The Film switch must be pressed and held until the X-ray Arm Assembly moves into position or K3 will unlatch.

The second set of contacts on the Film switch close simultaneously with the first set. Closure of the second set of contacts sends a command to the TGI PCB via ARCNet communication to initiate Film mode. The TGI CPU then closes relay (K2). When K2 closes, 24 Volts (MOTRON_24V) flows from the Table Control PCB through K2 and back to the Table Control PCB via the FILM_RDY signal. If both the hardware security signal and the software signal are present, the Motron CPU performs the following:

- Communicate the Film Cassettes presence and size to the TGI CPU via the Table Motion I/O Bus. The TGI CPU communicates the information to the Collimator CPU via the Collimator Interface PCB and ARCNet communication. The Collimator CPU sets the collimator leaves according to the detected film size. Leave positions are determined thru feedback from potentiometers.
- Moves the Film Cassette into position.
- The TGI CPU signals the generator via the CAN bus to prep the 1.2 mm filament.

- The Table Control CPU sends an active low signal to the TGI CPU via the FILM_SNS* signal.

The system is now ready to take a Film shot when an X-ray switch is pressed.

Automatic Exposure Control

When the Auto Exposure Control (AEC) button is pressed on the X-ray Control Console the key press is communicated from the switch matrix to the XCC Interface PCB. The XCC Interface PCB places the information on the data bus and the XCC CPU sends the information to the TGI via ARCNet communication and locks the mAs key on the X-ray Control Console.

The TGI puts the AEC enable command on the data bus and the TGI CPU processes it and sends the command to the generator via the CAN bus. The generator responds by enabling all the ion chamber's fields: ION_SEL1, ION_SEL2, and ION_SEL3 (left, center, and right with respect to the Urologist's view).

Ion Field Selection

When an Ion Field Select button is pressed on the X-ray Control Console the key press is communicated from the switch matrix to the XCC Interface PCB. The XCC Interface PCB places the information on the data bus and the XCC CPU sends the information to the TGI via ARCNet communication.

The TGI puts the command on the data bus and the TGI CPU processes it and sends the command to the generator via the CAN bus. The generator CPU responds by enabling or disabling the selected ion chamber field.

Note: If all the Ion Fields are disabled by the operator, the TGI CPU will respond by turning off AEC mode.

Optical Density Increment/Decrement

When an Optical Density Increment/Decrement button is pressed on the X-ray Control Console the key press is communicated from the switch matrix to the XCC Interface PCB. The XCC Interface PCB places the information on the data bus and the XCC CPU sends the information to the TGI via ARCNet communication.

The TGI puts the command on the data bus and the TGI CPU processes it and sends the command to the generator via the CAN bus. The generator CPU responds by incrementing or decrementing the mAs 12.5% for each switch step. The AEC calibration procedure establishes the default optical density for the system and stores the calibration data in the generator database.

X-ray Switch

Note: If the Film button is not pressed prior to initiating X-rays, a Fluoro exposure will be generated.

Pressing an X-ray switch to take a manual Film exposure initiates these actions:

- The technique is communicated to the generator via the CAN bus.
- A hardware control signal, EXP_DMD, (RTL-4) is sent from the TGI CPU to the Generator via RS-485 serial communication.
- A software control signal, XRAY_CMD, (RTL-2) is also sent from the TGI CPU to the Generator via RS-485 serial communication.

If all signals are received by the generator, the generator CPU selects the highest mA that the system allows and terminates the Film exposure when the mAs meter in the generator hardware reaches the desired mAs. When the exposure is terminated, the TGI CPU releases the relay and the software moves the Film Cassette back to its original position.

Pressing an X-ray switch with AEC enabled initiates these actions:

- The generator's AEC PCB monitors the output of the ion chamber STRT_INTG and determines when the required optical density on the film has been reached.
- The exposure is terminated when the software counter on the kV Control PCB reaches the optical density value that was established during AEC Calibration.

Fault Isolation

Functional Test	Failure	Possible Cause
Perform Film Exposure Test.	X-ray Arm Assembly fails to move.	Press the second Film switch. If the system still fails to respond, check the following: • ARCNet (see Communication section) • Cables between Table CPU (Motron CPU) and TGI PCB. • TGI PCB • Table Control PCB • Table Control PCB and motor circuits (see Table Motion section) • Motor
	Cassette fails to move.	Check: • Film Cassette Tray door is open. • Film Cassette Tray microswitch • Table Control PCB or TGI PCB • Associated cabling • Motor
	Collimator leaves fail to size.	Check: • Table Control PCB • TGI PCB • ARCNet • Collimator CPU • Associated cabling

Functional Test	Failure	Possible Cause
	X-rays are not generated when an X-ray switch is pressed.	Check: • X-ray security lines (see Interconnect Diagram) • CAN bus comm. (see Communication section
Perform Auto Exposure Control Test.	Optical density of film is unacceptable.	Perform an AEC Calibration. See *Calibration Section* of this manual.
Perform Ion Chamber Field Test	Inconsistent mAs or optical density readings on a field.	Check the gain potentiometer that corresponds to the failing ion chamber field (see *Adjustments* this section).

Functional Tests

Manual Film Exposure

1. Load a film cassette into the film tray.
2. Press and hold the FILM key. The Film LED will illuminate after the film cassette and X-ray Arm Assembly are positioned.
3. Disable Automatic Exposure Control (AEC) by pressing the AEC button. The AEC LED should be off.
4. Press and hold any X-ray switch, until you hear three beeps, indicating that the exposure is complete.
5. Remove the film cassette and develop the film.

Automatic Exposure Control

1. Load a film cassette into the film tray.
2. Press and hold the FILM key. The Film LED will illuminate, after the film cassette and X-ray Arm Assembly are positioned, indicating a film can be taken.
3. If the AEC LED is not lit, press the AEC button to enable AEC.
4. Press and hold any X-ray switch, until you hear three beeps, indicating that the exposure is complete.
5. Remove the film cassette and develop the film.
6. Measure the optical density of the film and verify with site administration that the optical density is acceptable. If the default optical density is not acceptable, perform an AEC Calibration. See the Calibration section.

Ion Chamber Field Test

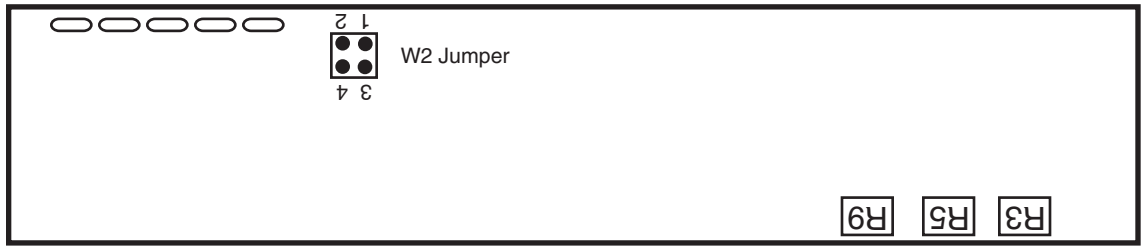
This procedure requires that the AEC and X-ray generator are working properly.

1. Set the kVp at 100.
2. Use 20 – 25 centimeters of water or an equivalent thickness of Plexiglas to cover all the ion chamber fields.
3. Center the X-ray beam on the center field and then collimate the beam so that it covers all the fields.
4. Take a series of X-rays and check the consistency of the fields optical density. Ion Chamber fields should have the same optical density consistently.
5. If the fields do not have balanced optical density readings, adjust the individual gain potentiometers on the Ion Chamber Preamplifier PCB. See the *Adjustment Section* for more information.

Adjustment

3-Field Preamp PCB (Ion Fields)

The 3-Field Preamp PCB has adjustments for left/right hand table configuration and Ion Chamber field gain adjustment.



3-Field Preamp PCB

Left/Right-hand Table Ion Field Configuration Jumper

The ion fields are configured using jumper W2, depending on whether the table is left or right handed. The Uroview table may have a left hand or right hand configuration. Left and right hand configuration is defined by facing the table from the side and seeing where the head end of the table is; to your left or right.

Table Configuration	W2 Jumpers
Left-hand	1-3, 2-4
Right-hand	1-2, 3-4

Ion Chamber Fields Preamp Gain Pot Adjustments

Individual gain adjustments are multi-turn potentiometers located on the Preamplifier PCB used with the three-field ion chamber. A clockwise adjustment increases the sensitivity of a field, causing the length of the exposure (mAs) to decrease. A counter-clockwise adjustment decreases the sensitivity of a field, causing the length of the exposure (mAs) to increase. Ion chamber locations are determined by viewing the table from the foot-end (Urologist's view).

Ion Field	Adjust Pot
Left	R9
Center	R5
Right	R3

Miscellaneous

Not applicable